REMARKS

Favorable reconsideration of this application is respectfully requested.

Claims 29 and 30 are pending in this application. Claims 27 and 28 are canceled by the present response without prejudice and new Claims 29 and 30 are added for examination. No new matter is believed to be added.[1]

Claims 27 and 28 were rejected under 35 U.S.C. § 103(a) as unpatentable over U.S. patent 5,703,962 to Astle in view of U.S. patent 6,415,055 to Kato. That rejection is traversed by the present response as discussed next.

New claims 29 and 30 are written to clarify features therein, and the features recited therein are believed to clearly distinguish over the applied art.

With respect to the outstanding rejection to previously pending claims 27 and 28, the outstanding rejection relied on Astle to disclose the previously recited claim features except for utilizing first and second flags, and to cure those deficiencies in Astle the outstanding rejection cited the teachings in Kato. That grounds for rejection specifically stated:

> However, the use of flags to indicate coding modes was common and notoriously well known in the art at the time of the invention, as an example Kato discloses transmitting a motion compensation mode 'flag' and an error flag to indicate using either a specific reference, or a bidirectional average (Kato col. 21 line 1 to col. 22 line 5). It is therefore considered obvious that one of ordinary skill in the art at the time of the invention would have recognized the advantage of using flags to indicate the encoding mode in Astle as was well-known in the art, in order to communicate the coding mode in a manner that requires little computation to decode.[2]

In reply to that grounds for rejection, applicants note the claims as currently written clarify the structure of the received encoding data, and particularly clarify that the received encoding data includes:

[1] New Claims 20 and 30 are supported by the original specification for example at page 47, line 14 to page 48, line 23.
[2] Office Action of August 2, 2007, page 3, second last paragraph.

(a) a first mode information for each of macroblocks, the first mode information indicating (a-1) a single prediction referring to a reference frame or (a-2) a composite prediction referring to a plurality of reference frames,

(b) a second mode information for each frame or each set of a plurality of frames, the second mode information indicating (b-1) an average value prediction or (b-2) a linear extrapolation prediction or linear interpolation prediction[.]

The claims as written also clarify the operation of generating the predictive macroblock. The claims as written are believed to clearly distinguish over Astle in view of Kastle.

First, applicants note the claims are not directed merely to conveying first mode information and second mode information to a decoding side. The claims allow an improvement in an encoding efficiency.

In the claimed invention, the first mode information indicates a single prediction referring to a reference frame or a composite prediction referring to a plurality of reference frames, and is encoded for each of macroblocks. Further, the second mode information indicates an average prediction or a linear interpolation/extrapolation prediction, and can be encoded as header data of a frame or header data of a plurality of frames. Those features are clarified in the currently written claims.

In other words, with the claimed invention the single prediction or composition prediction can be set for each macroblock. The average prediction or linear interpolation/extrapolation prediction can be set for every frame or for every plurality of frames. Thereby, the frequency of change between the single prediction and the composite prediction is higher than that of the frequency of change between the average prediction and the linear shape interpolation/extrapolation prediction.

The present inventors recognized the following circumstances.

A prediction precision increases as the frequency of changing the prediction mode increases. A prediction error decreases with an increase in the prediction precision. As a result, the number of encoded bits related to an image decreases. However, the number of

encoded bits related to prediction mode information increases as the frequency of changing the prediction mode increases.

In other words, even if the frequency of changing the prediction mode is increased, the encoding efficiency may not be improved. Accordingly, the frequency of changing the prediction mode cannot be determined, as clear to one skilled in the art. Thereby, the property of a moving image is considered when determining the frequency of changing the prediction mode.

Precision of the composite prediction is higher than that of the single prediction. However, the precision of the single prediction becomes higher than that of the composition prediction when an object hides in a shade of another object (concealment) or when an object appears from a shade of another object (appearance). This results because the object appearing from a shade of another object is seen only on a future frame, and an object that is going to hide in a shade of another object is seen only on a past frame.

An appearance and concealment of an object occur in a frame of a moving image locally. In other words, a frame of a moving image has a region in which the precision of the single prediction is higher than that of the composite prediction and a region in which the precision of the composition prediction is higher than that of the single prediction. When a single prediction or a composite prediction is set for every frame, the single prediction is used in the region for which the composition prediction is suitable, or the composite prediction is used in the region for which the single prediction is suitable, resulting in lowering the prediction precision. As a result, it becomes difficult to improve the efficiency of encoding.

The present inventors recognized the above-discussed environment, and the claimed invention addresses issues as noted above and provides video decoding methods and devices with enhanced efficiency.

In the claimed invention, the single prediction or composite prediction is set for every macroblock. The present inventors experimentally ensured that a decrease of the number of encoded bits due to improvement of prediction precision exceeds an increase of the number of encoded bits due to setting the prediction mode for every macroblock.

In general, precision of the average prediction is higher than that of the linear interpolation/extrapolation prediction. However, there is a case that precision of the linear interpolation/extrapolation prediction is higher than that of the average prediction, for example in a scene with a fade-in and fade-out in a moving image.

In a scene with a fade-in or fade-out, local time variation of the image can be approximated to a linear change. The linear sum according to a distance between a to-be-encoded image and each of a plurality of reference images provides a preferable approximation.

If a distance between a to-be-encoded image and each of a plurality of reference images is constant, an average prediction can be used.

However, the distance between a to-be-encoded image and each of a plurality of reference images may not be constant. In such a case, the precision of linear interpolation/extrapolation prediction is higher than that of average prediction.

In a scene with a fade-in and fade-out, time-series changes of all regions in a frame are similar to each other. In other words, when a frame has a region in which the precision of linear interpolation/extrapolation prediction is higher than that of average prediction, even in all other regions in the frame, the precision of linear shape interpolation/extrapolation prediction tends to be higher than that of average prediction. In contrast, when a frame has a region in which the precision of average prediction is higher that of linear interpolation/extrapolation, even in all other regions in the frame, the precision of average prediction tends to be higher than that of linear shape interpolation/extrapolation prediction.

Accordingly, even if the average prediction or linear interpolation/extrapolation prediction is set for every macroblock, an effect to improve prediction precision cannot be much expected. The efficiency of encoding deteriorates due to an increase of the number of encoded bits.

To address such issues, in the claimed invention, the average prediction or linear interpolation/extrapolation prediction is changed for every frame or every plurality of frames. The present inventors experimentally ensured that a decrease of the number of encoded bits due to improvement of the prediction precision exceeds an increase of the number of encoded bits due to changing the mode for every frame or every plurality of frames.

The features clarified in the claims and as discussed above are believed to clearly distinguish over Astle and Kato. That is, neither Astle or Kato disclose or suggest the above-noted features, and particularly the specifics of the received encoding data including both "a first mode information ...", "a second mode information", and "a predictive error signal", and further generating a predicted macroblock by operations (1)-(3) noted in the claims, and then further generating a decoded macroblock by adding the predicted macroblock and the predicted error signal.

Thereby, the claims as currently written are believed to distinguish over the applied art.

As no other issues are pending in this application, it is respectfully submitted that the present application is now in condition for allowance, and it is hereby respectfully requested that this case be passed to issue.

Respectfully submitted,

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